

Revision History

Document Title : PIPING MATERIAL CLASSIFICATION

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Rev. No.	Date	Description of Revision (Including the chapters and provisions of the revision)	Prepared by	Approved by
P0	2014-10-31	For Review	B.G.PARK	H.S.CHANG
P1	2015-01-15	Revised by 1 st TRM Modify the Material of Hydrogen Pipe (316 → 316L) Exclude the table of 7.0 Index of Piping Material Classification Because - repetition to Chapter 6.0 and Chapter 8.0 - piping material sheet is classified by material, rating and applicable code, not safety class or quality class.	B.G.PARK	H.S.CHANG
P2	2015-03-25	Revised by Comment of RID [OYSTER-RID-KHC-T150003]	B.G.PARK	H.S.CHANG
0	2015-07-09	For Construction	B.G.PARK	H.S.CHANG
Notes				

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EXHIBITS :

ABBREVIATIONS

TU-Delft	Delft University of Technology
CNS	Cold Neutron Source
BALL	Ball Type
BB	Bolted Bonnet
BC	Bolted Cap
BE	Beveled End
BW	Butt Weld
CF	Conflat Flange
CL	Class
DN	Nominal Diameter
FLG	Flange
FLGD	Flanged
GALVA	Galvanized
Gr.	Grade
HEX/NUT	Hexagon Nut
LIFT	Lift Type
LJ	Lapped Joint
NNS	Non-Nuclear-Safety
NW	Nominal Width
OS & Y	Outside Screw and Yoke Type

PE	Plain End
RF	Raised Face
RPTFE	Reinforced PTFE
SCH	Schedule
SMLS	Seamless
SO	Slip-on Weld
SS	Stainless Steel
SW	Socket Weld
SWING	Swing Type
WN	Welding Neck

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1.0 SCOPE

This specification covers the basic requirements for the design, materials and installation of the piping system in OYSTER Project.

This specification shall be applied to piping materials indicated on P&I diagrams. Piping systems, which are furnished, as a regular part of proprietary or standard equipment (or package facility), shall be in accordance with the equipment supplier's standard.

When the piping is connected to equipment, this specification shall be applied to the extent indicated below :

- 1) Companion flanges with gaskets, bolts and nuts at the equipment nozzle and the relief valves.
- 2) First shutoff valve with companion flange, gaskets, bolts and nuts in the instrument connecting line.


Note) "First shutoff valve" in instrument connecting line as used herein shall mean the nearest valve to a line to which the instrument is connected

This piping material classification shall not be applied to specially designed companion flanges, gaskets, bolts and nuts at the equipment nozzles.

2.0 CODES AND STANDARDS

2.1 Applicable Codes and Standards


Design, fabrication, testing and inspection of piping materials shall be accomplished in accordance with the following listed Codes and Standards including revision and addenda in effect as of the date of April 1, 2014, unless indicated otherwise;

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Pressure Equipment Directive (PED)

DIRECTIVE 97/23/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 29 May 1997.

ASME B31.1	Power Piping
ASME B31.12	Hydrogen Piping and Pipelines
ASME B36.10M	Welded and Seamless Steel Pipe
ASME B36.19M	Stainless Steel Pipe
ASME B16.9	Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	Forged Fittings, Socket-Welding and Threaded
ASME B16.25	Buttweld Ends
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.10	Face-to-Face and End-to-End Dimension of Valves
ASME B16.20	Metallic Gaskets for Pipe flanges
ASME B16.34	Valves - Flanged, Threaded, and Welding End
ASTM A312	Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipe
ASTM A403	Standard Specification for Wrought Austenitic Stainless Steel Piping Fitting
ASTM A182	Standard Specification for Forged or Rolled Alloy-Steel Pipe Flange, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service

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ASTM A194	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A351	Standard Specification for Casting, Austenitic, for Pressure-Containing Parts

2.2 Code & Quality Class Identification

The OYSTER Facility has no nuclear piping system which is classified as ASME Code Class 1, 2 and 3. The safety and quality classes of the piping systems for OYSTER Project are as follows :

HOR Safety Class : HOR SC2, HOR SC3, NNC

Quality Class : QC 2 (Explosion barrier transfer lines and blanket systems)

QC 3 (Need for a normal operation of the reactor)

Non-QC (Non-nuclear components not related to safety)

3.0 Unit

Unless otherwise specified, SI units shall be applied as the measurement system.

4.0 Material


Material for individual piping components shall conform to the requirements of the applicable Codes and Standards in Clause 2.1

All materials shall be procured in accordance with ASTM.

- ASME B31.1

Materials shall meet all requirements of ASME B31.1 and the applicable material specifications. The seller shall certify to meet that the applicable requirements of ASME B31.1 and this specification.

Products which contain asbestos are prohibited. This prohibition includes items such as

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packing or gasket even though the item is encapsulated or the asbestos fibers are impregnated with binder material.

5.0 Requirements

5.1 General

When two lines of different design pressure ratings are connected, the higher rating shall prevail up to and including the first shutoff valve on the line of the lower rating.

The design shall protect against freezing or solidification of high pour point fluids by heat tracing, steam jacketing, electrical heating, or draining, as required.

Where required, low points of piping shall be provided with valved drains and high points of piping shall be provided with valved vents. Vent, drain, and test connections required for hydrostatic testing shall be provided.

All piping shall be manufactured to be installed stress free, and designed with adequate flexibility to permit expansion of the piping without imposing excessive forces and moments on the connected equipment. Cold springing of piping in plant is not allowed.

Cast iron valve shall not be used.

Ball valves shall be used for the first shutoff valve of all instruments, except where noted.


To identify the material of piping support, refer to OYSTER-EP-GPI-DW-031

5.2 Pipe and Pipe Bends

Dimensions of pipes shall be in accordance with the following standards :

- ASME B36.10M Welded and Seamless Steel Pipe
- ASME B36.19M Stainless Steel Pipe

5.3 Pipe Size Restrictions

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The following nominal pipe size shall not be used except where required to connect to equipment.

- DN 10
- DN 32
- DN 90
- DN 125

5.4 Branch Connections

Welded attachments, including weldolets and pipe supports, shall be the same P-number as the base material.


Welding adapters and branch welded connections shall be reinforced to meet the requirements of Paragraph 104.3 of ASME B31.1, for Non-nuclear safety piping.

All reinforcement of pipe to pipe branch connections, which require reinforcement for external forces, shall have a thickness not less than 1.5 times the run pipe thickness and a diameter twice the branch pipe diameter.

Duplication of reinforcement for both internal pressure and external force is not required.

The following branch connections on stressed piping systems are permitted.

- ASME B16.9 , Tee
- Small branch connection ; i.e., sockolet, weldolet, coupling, boss, etc., on pipe.

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5.5 Fittings

- 1) Dimensions of fittings shall be in accordance with the following standards
 - ASME B16.9 Factory-Made Wrought Steel Buttwelding Fittings
 - ASME B16.11 Forged Fittings, Socket-Welding and Threaded
 - ASME B16.25 Buttweld Ends
 - ASME B16.28 Wrought Steel Buttwelding Short Radius Elbows and Return
- 2) Long radius elbows shall be generally used for all piping.

In jacket pipe system, short radius elbow shall be used for outer pipe.
- 3) Welded fittings shall be used in preference to flanged fittings.
- 4) Pipe bends shall be used to the maximum extent possible to eliminate welds.
- 5) Reducing tees or elbows may be used where their use results in improved arrangements.
- 6) Minimum schedule of threaded nipples shall be 80 for carbon steel and 40S for stainless steel.

5.6 Flanges

- 1) Dimensions of flanges shall be in accordance with the following standard
 - ASME B16.5 Pipe Flanges and Flanged Fittings
 - ASME B16.36 Orifice Flanges
- 2) All steel flanges, except as stipulated in above standards or noted on the piping drawings, shall be raised face in accordance with ASME B16.5.
- 3) Reducing welding neck flanges shall normally not be used.
- 4) In pipe classes which specify Class 150 flanges, any required orifice flanges shall be Class 300.
- 5) Orifice flanges shall be in accordance with ASME B 16.36. and bolting and gaskets

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shall be in accordance with its applicable Pipe Material Classification Sheets request

- 6) In case where a flanged connection is made between different types of materials, the mating surface shall be electronically insulated from each other. The flanged joints shall be furnished with plastic washers under the bolt head and plastic ferrules for bolts; electrically nonconducting gasket shall be used.
- 7) For vacuum system, maker standard flange type(NW, CF) should be used.

5.7 Valves

- 1) Dimensions of valves shall be in accordance with the following standards.
 - ASME B16.10 Face-to-Face and End-to-End Dimension of Valves
 - ASME B16.34 Valves - Flanged, Threaded, and Welding End
- 2) Check valves, including those which are spring loaded, should be installed so that the force of gravity assist in closing and holding the disc, ball, or clapper on seat.
- 3) Swing check valves should not be used in vertical pipe handling liquid at high heads.
- 4) Bonnet, yoke, and stem of rising stem gate valves, when below ground and not in trenches, shall be protected with valve boxes or other suitable means.
- 5) Valves may be provided with standard stem handwheels if handwheel rim pull is less than 45.4 kgf (100 lb), for a maximum differential pressure equal to the maximum cold working pressure of the valve's pressure rating.

If the above rim pull is exceeded with a stem handwheel, gear operators shall be provided. Rim pull for gear operators shall not exceed 45.4 kgf (100 lb). The maximum allowable gear operator handwheel diameter is 750 mm.

- 6) Hand valves shall be accessible and operable easily from the floor level. If not, operational platforms shall be provided.
- 7) Hand-gear operation shall be required for following valve size and rating.

ASME Rating	Gate Valve	Globe Valve	Plug/Ball Valve	Butterfly Valve
150	100A and Larger	100A and Larger	100A and Larger	100A and Larger
300	100A and Larger	100A and Larger	100A and Larger	100A and Larger
600	100A and Larger	100A and Larger	100A and Larger	-
Gear Type	Bevel-gear Type	Bevel-gear Type	Worm-gear Type	Worm-gear Type

5.8 Weld End Preparation for Piping

End preparation for butt weld shall be in accordance with ASME B16.25, as applicable.

- ASME B16.25 Buttwelding Ends
- Ends of pipe for socket welding shall be square cut.

6.0 Piping Material Classification

The piping material classifications to describe the detailed and specific requirements for the piping system for OYSTER Project are defined as follows:

Ex) Line No. : OYSTER-CU-HYD-80-L001-

(1)	(2)	(3)
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First Letter (1)	ASME Rating	Second Letter (2)	Material	Third Letter (3)	Applicable Code
A	Special Rating	X	A312 TP316	C	ASME Class3
B	2500#	Z	A312 TP316L	D	ASME B31.1
C	1500#	C	A312 TP304		
D	900#				
E	600#				
F	400#				
G	300#				
H	150#				

<u>Class</u>	<u>Description</u>	<u>Applicable Code</u>
CXD	1500# Stainless Steel 316 Piping	ASME B31.1
GXD	300# Stainless Steel 316 Piping	ASME B31.1
HXD	150# Stainless Steel 316 Piping	ASME B31.1
GZD	300# Stainless Steel 316L Piping	ASME B31.1
HCD	150# Stainless Steel 304 Piping	ASME B31.1

7.0 Pressure & Temperature Instrument Connection

Main Pipe Line Class	Pressure Instrument Connection	Temperature Instrument Connection
600# Flange Rating Classes & Lower	DN 20A Socket Welding Half Coupling	DN 25A Socket Welding Half Coupling (Fig.1)

Note 1) If the size of line is less than DN 80A for thermowell installation, the size of line shall be increased to DN 100A.

2) Both pressure and temperature indicators shall be positioned to be read easily.

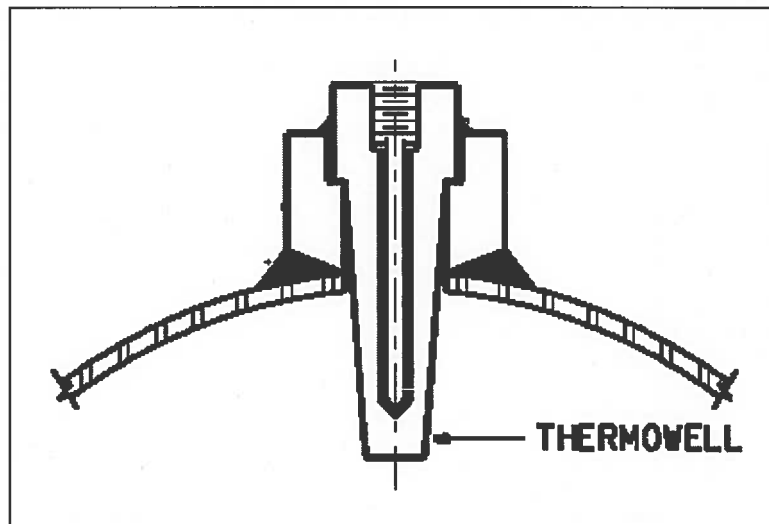




Fig. 1 - Temperature Instrument Connection


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8.0 Pipe Material Classification Sheets


The piping systems are classified according to their design conditions and designated with associated piping material class. The pipe material classification sheet specifies the detailed requirements for each component of associated piping system with designation of piping material class.

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DESIGN CONDITION	SYSTEM				MATERIAL CLASS	CXD		
60 °C 15.101 Mpa (a)	- Nitrogen Gas Supply Pipe - Helium Gas Supply Pipe				SERVICE RATING	ASME CL.1500#		
CORROSION ALLOWANCE					APPLICATION CODE	ASME B31.1		
0.3 mm					MATERIAL	STAINLESS STEEL		
PIPE AND FITTING					VALVE			
ITEM	SIZE (DN)	WALL THK. or RATING	MATERIAL	DESCRIPTION	SIZE (DN)	DESCRIPTION	VALVE CODE	
PIPE	15A~50A	SCH.80	A 312 TP316	SMLS, PE	GATE			
	65A~200A	SCH.80	A 312 TP316	SMLS, BE	15A ~ 50A 65A ~ 200A	A 182 F316, 1500#, SW A 351 CF8M, 1500#, BW	HZD-GTA	
TUBE	15A O.D & smaller	0.065"	A 213 TP316	SMLS, Tube			HZD-GTB	
FITTING	15A ~ 50A	SCH.80 / 3000#	A 182 F316	SMLS, SW	GLOBE			
	65A ~ 200A	SCH.80	A 403 WP316	SMLS, BW	15A ~ 50A 65A ~ 200A	A 182 F316, 1500#, SW A 351 CF8M, 1500#, BW	HZD-GBA	
TUBE FITTING	15A O.D & smaller	Comp.	A 182 F316	HZD-GBB				
FLANGE	15A ~ 50A	1500# / SCH.80s	A 182 F316	SW, RF	CHECK			
	65A ~ 200A	1500# / SCH.80S	A 182 F316	SO, RF	15A ~ 50A 65A ~ 200A	A 182 F316, 1500#, SW, Y-LIFT A 351 CF8M, 1500#, BW, SWING	HZD-CKA HZD-CKB	
GASKET	ALL	1500#	4.5mm THK. SPIRAL WOUND 316SS, WITH GRAPHITE FILLER, INNER RING & CENTERING RING WITH 316SS PER ASME B16.20		BALL			
					15A ~ 50A 65A ~ 200A	A 182 F316, 1500#, SW A 351 CF8M, 1500#, BW	HZD-BLA HZD-BLB	
BOLT / NUT	ALL	- STUD BOLTS : A 193 Gr.B8M CL.2 - HEAVY HEX NUTS : A 194 Gr.8M						
PLATE		A 240 Gr. 316			PRESSURE-TEMPERATURE RATING ASME B16.34(GROUP 2.2) STANDARD CLASS			
NOTE 1. Wall thickness of pipe after bending must meet applicable Code requirement for specific system design condition ; heavier wall pipe may be used for bends, if required. 2. Fitting joining pipe of different schedule should conform to the higher schedule.					TEMP. (°C)	PRESSURE [Mpa (g)]	TEMP. [°F]	PRESSURE [psi (g)]
					38	24.82	100	3600
					60	23.47	140	3404
					80	22.28	176	3231
					100	21.10	212	3060

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DESIGN CONDITION	SYSTEM				MATERIAL CLASS	GXD						
80 °C 3 Mpa (a)	- Vacuum Jacket(Inner & Outer) Pipe - Gas Blanket Jacket Pipe, Hydrogen Box & Buffer Tank and Vacuum Box to First Isolation Valve - Gas Blanket Pipe from last Isolation valve to Vacuum Box, Vacuum Valve Box, 3-way Valve, Hydrogen Buffer Tank, IPA flange, Blanket Jacket Pipe - Vacuum System Pipe from Vacuum Box to Discharged Gas Collection Tank - Hydrogen Jacket(Outer) Pipe				SERVICE RATING	ASME CL.300#						
CORROSION ALLOWANCE					APPLICATION CODE	ASME B31.1						
0.3 mm					MATERIAL	STAINLESS STEEL						
PIPE AND FITTING					VALVE							
ITEM	SIZE (DN)	WALL THK. or RATING	MATERIAL	DESCRIPTION	SIZE (DN)	DESCRIPTION	VALVE CODE					
PIPE	15A~50A	SCH.40S	A312 TP316	SMLS, BE	GATE							
	65A~200A	SCH.10S	A312 TP316	SMLS, BE	15A~50A 65A ~ 200A	A182 F316, 600#, SW A 351 CF8M, 300#, BW	GXD-GTA GXD-GTB					
TUBE	15A O.D & smaller	0.065"	A213 TP316	SMLS. Tube								
FITTING	15A ~ 50A	SCH.40S	A 403 WP316	SMLS, BW	GLOBE							
	65A ~ 200A	SCH.10S	A 403 WP316	SMLS, BW	15A~50A 65A ~ 200A	A182 F316, 600#, SW A 351 CF8M, 300#, BW	GXD-GBA GXD-GBB					
TUBE FITTING	15A O.D & smaller	Comp.	A182 F316									
FLANGE ¹	15A ~ 50A	300# / SCH.40S	A 182 F316	SW, RF	CHECK							
	65A ~ 200A	300# / SCH.10S	A 182 F316	SO, RF	15A~50A 65A ~ 200A	A182 F316, 600#, SW, Y-LIFT A 351 CF8M, 300#, BW, SWING	GXD-GBA GXD-GBB					
GASKET ¹	ALL	300#	4.5mm THK. SPIRAL WOUND 316SS, WITH GRAPHITE FILLER, INNER RING & CENTERING RING WITH 316SS PER ASME B16.20		BALL							
					15A~50A 65A ~ 200A	A182 F316, 600#, SW A 351 CF8M, 300#, BW	GXD-BLA GXD-BLB					
BOLT / NUT	ALL	- STUD BOLTS : A 193 Gr.B8M CL.2 - HEAVY HEX NUTS : A 194 Gr.8M			Packless, Bellows Sealed Valve							
PLATE		A 240 Gr.316			15A ~ 50A	A 182 F316, 600#, SW	GXD-PBA					
NOTE 1. Electro Polishing is required in the inside of the pipe and inside & outside of Jacket inner pipe. - Max Surface roughness ≤ 0.9 μm - Average Surface roughness ≤ 0.5 μm 2. Wall thickness of pipe after bending must meet applicable Code requirement for specific system design condition ; heavier wall pipe may be used for bends, if required. 3. Fitting joining pipe of different schedule should conform to the higher schedule. 4. For Vacuum Sys. maker standard flange type(NW,CF) should be used.					PRESSURE-TEMPERATURE RATING ASME B16.34(GROUP 2.2) STANDARD CLASS							
					TEMP. [°C]	PRESSURE [Mpa (g)]	TEMP. [°F]	PRESSURE [psi (g)]				
					38	4.96	100	720				
					60	4.69	140	680				
					80	4.46	176	647				
100	4.22	212	612									

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DESIGN CONDITION		SYSTEM			MATERIAL CLASS		GZD		
60 °C, 3 Mpa (a)		- Helium Transfer pipe(Inner & Outer)[TBD] - Hydrogen Jacket(Inner) Pipe - Hydrogen Pipe From Hydrogen Box To First Isolation Valve			SERVICE RATING		ASME CL.300#		
CORROSION ALLOWANCE					APPLICATION CODE		ASME B31.1		
0.3 mm					MATERIAL		STAINLESS STEEL		
PIPE AND FITTING					VALVE				
ITEM	SIZE (DN)	WALL THK. or RATING	MATERIAL	DESCRIPTION	SIZE (DN)	DESCRIPTION	VALVE CODE		
PIPE	15A~50A	SCH.40S	A 312 TP316L	SMLS, BE	GATE				
	65A~200A	SCH.10S	A 312 TP316L	SMLS, BE	15A ~ 50A	A 182 F316L, 600#, SW	GZD-GTA		
					65A ~ 200A	A 351 CF8M, 300#, BW	GZD-GTB		
FITTING	15A ~ 50A	SCH.40S	A403 WP316L	SMLS, BW	GLOBE				
	65A ~ 200A	SCH.10S	A403 WP316L	SMLS, BW	15A ~ 50A	A 182 F316L, 600#, SW	GZD-GBA		
					65A ~ 200A	A 351 CF8M, 300#, BW	GZD-GBB		
FLANGE	15A ~ 50A	300# / SCH.40S	A 182 F316L	SW, RF	CHECK				
	65A ~ 200A	300# / SCH.10S	A 182 F316L	SO, RF	15A ~ 50A	A 182 F316L, 600#, SW, Y-LIFT	GZD-CKA		
					65A ~ 200A	A 351 CF8M, 300#, BW, SWING	GZD-CKB		
GASKET	ALL	300#	4.5mm THK. SPIRAL WOUND 316SS, WITH GRAPHITE FILLER, INNER RING & CENTERING RING WITH 316SS PER ASME B16.20	BALL					
				15A ~ 50A	A 182 F316L, 600#, SW		GZD-BLA		
					65A ~ 200A	A 351 CF8M, 300#, BW		GZD-BLB	
BOLT / NUT	ALL	- STUD BOLTS : A 193 Gr.B8M CL.2 - HEAVY HEX NUTS : A 194 Gr.8M							
PLATE		A 240 Gr. 316L			PRESSURE-TEMPERATURE RATING ASME B16.34(GROUP 2.3) STANDARD CLASS				
NOTE : 1. Electro Polishing is required in the inside of the pipe and inside & outside of Jacket inner pipe. - Max Surface roughness $\leq 0.9 \mu\text{m}$ - Average Surface roughness $\leq 0.5 \mu\text{m}$ 2. Wall thickness of pipe after bending must meet applicable Code requirement for specific system design condition ; heavier wall pipe may be used for bends, if required. 3. Fitting joining pipe of different schedule should conform to the higher schedule. 4. For Cryogenic Jacket pipe, maker standard flange type(NW,CF) should be used.					TEMP. (°C)	PRESSURE [Mpa (g)]	TEMP. [°F]	PRESSURE [psi (g)]	
					38	4.14	100	600	
					60	3.90	140	565	
					80	3.69	176	535	
					100	3.48	212	505	

DESIGN CONDITION		SYSTEM			MATERIAL CLASS		HXD	
100 °C 1 Mpa (a)		- Other Gas Blanket Pipe - Vacuum Pipe in Vacuum Box			SERVICE RATING		ASME CL. 150#	
CORROSION ALLOWANCE					APPLICATION CODE		ASME B31.1	
0.3 mm					MATERIAL		STAINLESS STEEL	
PIPE AND FITTING					VALVE			
ITEM	SIZE (DN)	WALL THK. or RATING	MATERIAL	DESCRIPTION	SIZE (DN)	DESCRIPTION	VALVE CODE	
PIPE	15A~50A	SCH.40S	A312 TP316	SMLS, PE	GATE			
	65A~200A	SCH.10S	A312 TP316	SMLS, BE	15A~50A 65A ~ 200A	A182 F316, 600#, SW A 351 CF8M, 150#, BW	HXD-GTA	
TUBE	15A O.D & smaller	0.065"	A213 TP316	SMLS. Tube			HXD-GTB	
FITTING	15A ~ 50A	SCH.40S / 3000#	A 182 F316	SMLS, SW	GLOBE			
	65A ~ 200A	SCH.10S /150#	A 403 WP316	SMLS, BW	15A~50A 65A ~ 200A	A182 F316, 600#, SW A 351 CF8M, 150#, BW	HXD-GBA HXD-GBB	
TUBE FITTING	15A O.D & smaller	Comp.	A182 F316		CHECK			
					15A~50A 65A ~ 200A	A182 F316, 600#, SW, Y-LIFT A 351 CF8M, 150#, BW, SWING	HXD-CKA HXD-CKB	
FLANGE	15A ~ 50A	150# / SCH.40S	A 182 F316	SW, RF	BALL			
					15A~50A 65A ~ 200A	A182 F316, 600#, SW A 351 CF8M, 150#, BW	HXD-BLA HXD-BLB	
	65A ~ 200A	150# / SCH.10S	A 182 F316	SO, RF	DIAPHRAGM			
GASKET	ALL	150#	4.5mm THK. SPIRAL WOUND 316SS, WITH GRAPHITE FILLER, INNER RING & CENTERING RING WITH 316SS PER ASME B16.20		Packless, Bellows Sealed Valve			
					15A ~ 50A	A 182 F316, 600#, SW	HXD-PBA	
					Three Way			
BOLT / NUT	ALL	- STUD BOLTS : A 193 Gr.B8M CL.2 - HEAVY HEX NUTS : A 194 Gr.8M			PRESSURE-TEMPERATURE RATING ASME B16.34(GROUP 2.2) STANDARD CLASS			
					15A ~ 50A	A 182 F316, 600#, SW	HXD-TWA	
PLATE		A 240 Gr.316			TEMP. (°C)	PRESSURE [Mpa (g)]	TEMP. [°F]	PRESSURE [psi (g)]
NOTE : 1. Wall thickness of pipe after bending must meet applicable Code requirement for specific system design condition ; heavier wall pipe may be used for bends, if required. 2. Fitting joining pipe of different schedule should conform to the higher schedule. 3. Electro Polishing is required in the inside of the pipe and inside & outside of Jacket inner pipe.[TBD] - Max Surface roughness ≤ 0.9 μm - Average Surface roughness ≤ 0.5 μm 4. For Vacuum Sys, maker standard flange type(NW,CF) should be used.					38	1.90	100	275
					60	1.80	140	260
					80	1.71	176	250
					100	1.62	212	235

DESIGN CONDITION	SYSTEM				MATERIAL CLASS	HZD		
100 °C 1 Mpa (a)	- Hydrogen Pipe in Hydrogen Box - Hydrogen Pipe From First Isolation Valve To Discharged Gas Collection Tank - Hydrogen Pipe from Hydrogen Box to Hydrogen Buffer Tank				SERVICE RATING	ASME CL. 150#		
CORROSION ALLOWANCE					APPLICATION CODE	ASME B31.1, B31.12		
0.3 mm					MATERIAL	STAINLESS STEEL		
PIPE AND FITTING					VALVE			
ITEM	SIZE (DN)	WALL THK. or RATING	MATERIAL	DESCRIPTION	SIZE (DN)	DESCRIPTION	VALVE CODE	
PIPE	15A~50A	SCH.40S	A312 TP316L	SMLS, PE	GATE			
	65A~200A	SCH.10S	A312 TP316L	SMLS, BE	15A~50A 65A~200A	A182 F316L, 600#, SW A 351 CF8M, 150#, BW	HSD-GTA	
TUBE	15A O.D & smaller	0.065"	A213 TP316L	SMLS. Tube			HSD-GTB	
FITTING	15A ~ 50A	SCH.40S / 3000#	A 182 F316L	SMLS, SW	GLOBE			
	65A ~ 200A	SCH.10S / 150#	A 403 WP316L	SMLS, BW	15A~50A 65A ~ 200A	A182 F316L, 600#, SW A 351 CF8M, 150#, BW	HSD-GBA HSD-GBB	
TUBE FITTING	15A O.D & smaller	Comp.	A182 F316L		CHECK			
					15A~50A 65A ~ 200A	A182 F316L, 600#, SW, Y-LIFT A 351 CF8M, 150#, BW, SWING	HSD-CKA HSD-CKB	
FLANGE	15A ~ 50A	150# / SCH.40S	A 182 F316L	SW, RF	BALL			
	65A ~ 200A	150# / SCH.10S	A 182 F316L	SO, RF	15A~50A 65A ~ 200A	A182 F316L, 600#, SW A 351 CF8M, 150#, BW	HSD-BLA HSD-BLB	
GASKET	ALL	150#	4.5mm THK. SPIRAL WOUND 316SS, WITH GRAPHITE FILLER, INNER RING & CENTERING RING WITH 316SS PER ASME B16.20		Packless, Bellows Sealed Valve			
					15A ~ 50A	A 182 F316L, 600#, SW	HSD-PBA	
					Three Way			
					15A ~ 50A	A 182 F316L, 600#, SW	HSD-TWA	
BOLT / NUT	ALL	- STUD BOLTS : A 193 Gr.B8M CL.2 - HEAVY HEX NUTS : A 194 Gr.8M		PRESSURE-TEMPERATURE RATING ASME B16.34(GROUP 2.3) STANDARD CLASS				
PLATE		A 240 Gr.316L			TEMP. (°C)	PRESSURE [Mpa (g)]	TEMP. [°F]	PRESSURE [psi (g)]
NOTE : 1. Wall thickness of pipe after bending must meet applicable Code requirement for specific system design condition ; heavier wall pipe may be used for bends, if required. 2. Fitting joining pipe of different schedule should conform to the higher schedule. 3. Electro Polishing is required in the inside of the pipe and inside & outside of Jacket inner pipe. - Max Surface roughness ≤ 0.9 μm - Average Surface roughness ≤ 0.5 μm 4. For Vacuum Sys, maker standard flange type(NW,CF) should be used.					38	1.59	100	231
					60	1.49	140	216
					80	1.41	176	205
					100	1.33	212	193

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9.0 Valve Code & Identification

(1) - (2)

(1) Piping Material Classification

Refer to Clause 6. Piping Material Classification.

(2) Type of Valve

GT : Gate GB : Globe

CK : Check BL : Ball

DP : Diaphragm PB : Packless, Bellows Sealed

TW : Three Way

1) Gate Valves


- GTA: socket weld ends, bolted bonnet, OS&Y, solid wedge, hardfaced seats and wedge
- GTB: butt weld ends, bolted bonnet, OS&Y, flexible wedge, hardfaced seats and wedge

2) Globe Valves

- GBA: socket weld ends, bolted bonnet, OS&Y, solid wedge, hardfaced seats and wedge
- GBB: butt weld ends, bolted bonnet, OS&Y, flexible wedge, hardfaced seats and wedge

3) Check Valves

- CKA: socket weld ends, bolted cap, spring loaded piston type disc(y-lift), hardfaced seat and disc
- CKB: butt weld ends, bolted cap, swing type disc, hardfaced seats and disc

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4) Ball Valves

- BLA: socket weld ends, full bore 900 turn, SS TP316/316L ball, teflon seat
- BLB: butt weld ends, full bore 900 turn, SS TP316/316L ball, teflon seat

5) Diaphragm Valve

- DPA: socket weld ends, high pressure type, Ni-Co Alloy Diaphragm, RPTFE seat

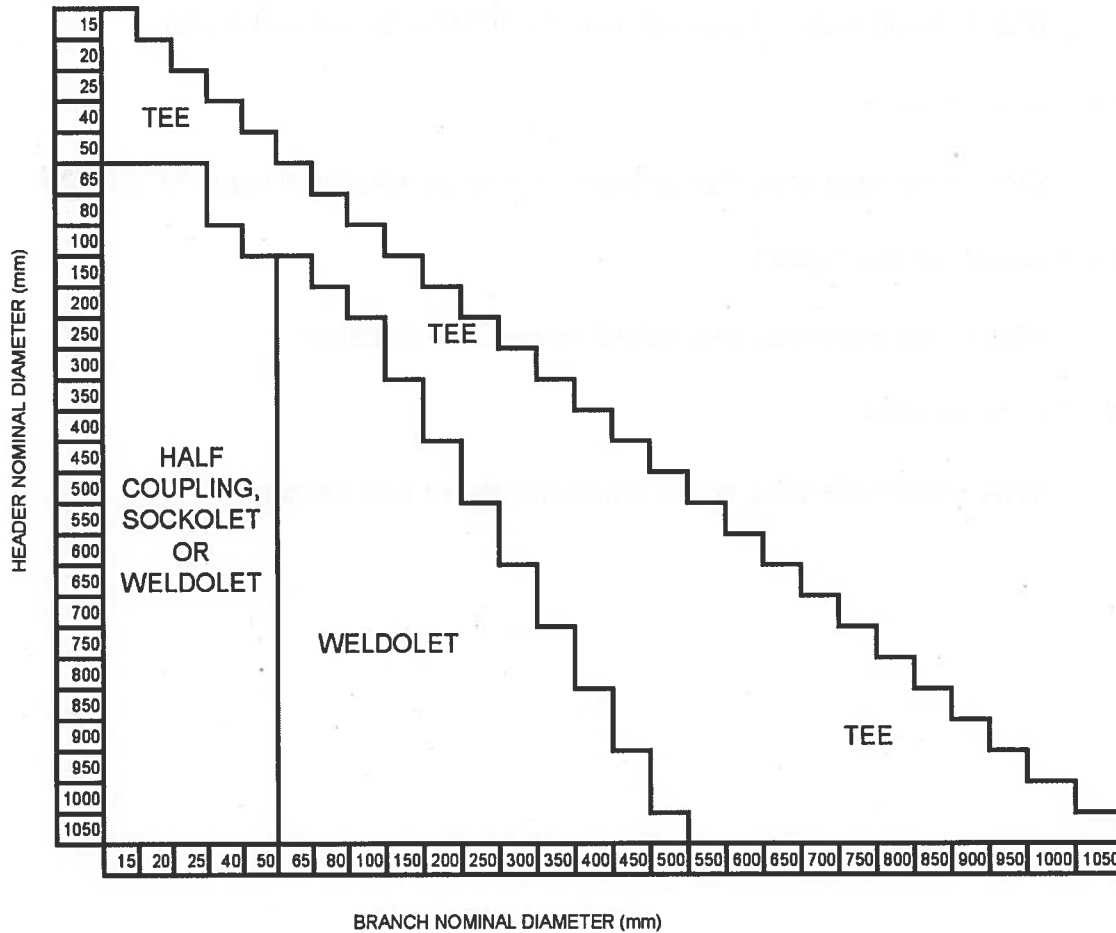
6) Packless, Bellows Sealed

- PBA: socket weld ends, seal welded bonnet, zero emission

7) Three Way Valve

- TWA: socket weld ends, bolted bonnet, hardfaced seat and disc

10.0 Branch Connection Table



Note

- 1) All branch connections shall be certified by the fabricator for proper integral reinforcement details and conformance to ASME B31.1 as applicable.

- 2) Special branch connections such as for safety relief valve nozzle are outside the scope of this table. Stress analysis group should be consulted for any special branch connection design